spirit and what is called the religious sentiment. "Religion," said Bishop Creighton, "means the knowledge of our destiny and of the means of fulfilling it." We can say no more and no less of science. Men of science seek, in all reverence, to discover the Almighty, the Everlasting. They claim sympathy and friendship with those who, like themselves, have turned away from the more material struggles of human life, and have set their hearts and minds on the knowledge of the Eternal.

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## *THE ITHACA MEETING OF THE AMERICAN CHEMICAL SOCIETY. II.*

### SECOND GENERAL SESSION.

At the second general session the following addresses were given:

*Hydronitric Acid:* L. M. Dennis.

*Recent Progress in Industrial Chemistry:* J. D. Pennock.

The address first cites the rapid progress of the ammonia soda process in comparison with the Le Blanc, showing that from 1870 to 1903 the world's production of soda by the ammonia process increased from 2,600 to 1,150,000 tons per annum, and the Le Blanc process decreased from 447,000 in 1870 to 150,000 in 1903. The reason for the continuance of industrial life in the Le Blanc works is the income obtained from bleaching powder and sulphur products. The progress of the electrolytic process is then discussed and a statement is made that in 1905 considerable profit was made by at least two concerns in England on the manufacture of electrolytic caustic soda and bleaching powder. Comment was made on the development of the treatment of fatty acids by carbonate of soda in the manufacture of soap, rather than the old method of treating neutral fats with caustic soda and thereby making a considerable saving. It was predicted that the tendency in industrial operations to the use of fuel gas from coke ovens and producers will ultimately do away with the smoke nuisance. The utilization of peat for producer gas and in the making of crude paper are interesting developments along this line. The introduction of alcohol free from tax after January 1, 1907, will call for a denaturizing substance of some sort. Doubtless the United States will follow the German practise of using a 2.5 per cent. solution made up of four liters of wood alcohol and one liter of pyridine added to 100 liters of alcohol. The future source of suitable nitrogen for the soil was then discussed. First dealing with Dr. Frank's calcium cyanimide process, then with Birkland and Eydes fixation of atmospheric nitrogen, and with the immediate and more practical application of ammonium sulphate manufactured on a large scale by the by-product coke ovens. It was predicted that in about thirty years the supply of nitrate of soda will be exhausted. The source of nitrogen must then be furnished by one of the above described processes.

*Some Problems of Biological Chemistry:* Waldemar Koch.

It was pointed out that it is possible to investigate a tissue from the point of view of a chemist without isolating definite chemical substances, by dividing the constituents into the following groups: proteids, carbohydrates, fats, lecithins, extractives, ash. These groups have a physiological significance and the distribution among them of definite substances or elements like phosphorus, which was especially discussed, can vary in some of these groups within wide limits under different physiological conditions. The possibility of determining the physiological value of the different combinations of phosphoric acid to the cell was illustrated by a number of examples.

INORGANIC CHEMISTRY.

L. M. Dennis, Chairman.

*Some New Compounds of Thallium:* L. F. Hawley.

Three new compounds of thallium were described: thallium fulminate, $Tl_2C_2N_2O_2$, thallium aluminate, $Tl_4Al_2O_5 . 2H_2O$, and potassium thallic chromate, $K_2CrO_4 . Tl_2(CrO_4)_3 . 4H_2O$.

*Experiments upon the Radium Emanation:* L. F. Hawley.

With the idea in view that the rare atmospheric gases might be the activizing agents of radioactive bodies an attempt was made to find whether the atmosphere produced any effect on the emanations from radium. A water solution of radium chloride was kept in an atmosphere of hydrogen entirely free from the atmospheric gases, and the emanations produced during several three-day periods were measured by bubbling the pure hydrogen through the solution and leading the hydrogen and emanation into a measuring tube connected with an electrometer. Then similar measurements were made under exactly the same conditions except that air was used in the place of the hydrogen. No difference was found except that due to the difference in the absorption of the radiations by the hydrogen and the air.

*On the Reaction between Hydrazine Sulphate and Potassium Chlorate:* A. W. Browne.

This reaction does not proceed in presence of sulphuric acid entirely in accordance with the general equation for the oxidation of hydrazine sulphate as given by Roberto and Roncali:

$$N_2H_4 . H_2SO_4 + 2O = N_2 + 2H_2O + H_2SO_4.$$

Three series of experiments have been made, from which it is evident that the reaction takes place very largely as expressed by the following equation:

$$4N_2H_4 . H_2SO_4 + 4O = 2HN_3 + (NH_4)_2SO_4 + 3H_2SO_4 + 4H_2O.$$

Within certain limits the yield of $HN_3$ varies directly with the amount of $H_2SO_4$ present and inversely with the excess of $KClO_3$. Under favorable conditions the yield amounts to over 23 per cent. of theory according to the above equation.

*A Modified Hydrogen Sulphide Generator:* A. W. Browne and M. F. Mehling.

The apparatus is essentially a modified Ostwald gas generator capable of furnishing hydrogen sulphide in quantities sufficient to supply a class of 275 students. The supply of acid (1:1 HCl) and the discharge of the thoroughly neutralized spent acid is automatically regulated by a method somewhat similar in principle to that employed in the Parsons apparatus.

*On the Analysis of Silver Trinitride:* L. M. Dennis and A. W. Browne. (By title.)

*Colorimetric Determination of Iron with special reference to Purity of Reagents:* H. N. Stokes and J. R. Cain.

The interfering action of large amounts of acids or salts is avoided by concentrating the iron, either by evaporation in the case of easily volatile substances or by carrying down as hydroxide by manganese dioxide (reduced from permanganate) or as sulphide by cadmium sulphide. After suitable treatment it is dissolved in free sulphocyanic acid saturated with mercuric sulphocyanate, and after adding a little persulphate is extracted with amyl alcohol in the colorimeter cylinder, the duplicate cylinder containing the same volume of sulphocyanic acid and amyl alcohol. Less than 0.001 mg. iron may thus be detected in 50 grams of a non-volatile salt.

*Beryllium Carbonate:* Charles L. Parsons and Edwin J. Roberts.

Normal beryllium carbonate can not be

made at ordinary pressures in contact with water. $BeCO_4 + 4HO$ described by Klatzo does not exist, and attempts to make it by his method yield only slightly carbonated hydroxide. Basic beryllium carbonate appears to have no definite composition and can be almost completely converted into the hydroxide by boiling in water. All attempts to increase the proportion of the $CO_2$ components over the proportion $2Be(OH)_2 . BeCO_3$ failed, although $CO_2$ was passed for three months through the basic carbonate under slightly increased pressure. The basic carbonates described in literature must have contained at least one or two per cent. of the carbonate used as a solvent or precipitant.

*The Separation and Estimation of Beryllium:* CHAS. L. PARSONS and STUART R. BARNES.

Beryllium is separated from aluminum and iron by the complete solubility of its hydroxide in a hot saturated solution of acid sodium carbonate—ferric hydroxide and aluminum hydroxide being completely insoluble. Double precipitation is essential. Beryllium hydroxide must be washed with water containing an electrolyte in solution, for when pure it rapidly washes through the filter in a colloidal condition. Sodium acetate used in this manner gave excellent results.

*The Elementary Nature of Tellurium:* J. F. NORRIS.

On account of the fact that the atomic weight of tellurium is inconsistent with its position in the family which contains sulphur and selenium in the periodic classification of the elements, the author undertook a series of experiments to determine whether tellurium contains an undiscovered element. In order to free the tellurium from any element which does not belong to the sulphur family, it was converted into the compound $Na_2S_4TeO_6$, and from this derivative of sodium pentathionate, the tellurium was separated. In order to determine whether the element contained another element in the sulphur family, with an atomic weight higher than that of tellurium, a sample of carefully purified tellurium dioxide was subjected to fractional sublimation. Atomic weight determinations were made of the element in the various fractions as well as of that in the unsublimed oxide and of the tellurium prepared from the derivative of the sodium pentathionate. The result was the same in all cases, namely, 127.6. The work establishes more definitely than has been done heretofore the elementary nature of tellurium.

*On the Mercuri-ammonium Salts and Bases:* E. C. FRANKLIN.

It will be shown in this paper that the so-called mercuri-ammonium salts are not substituted ammonium salts at all, but are to be classified under the three heads as (1) mercury salts with ammonia of crystallization, (2) ammoni-basic mercuric salts, and (3) mixed hydro-basic ammono-basic mercuric salts. For example, the fusible white precipitate is mercuric chloride with ammonia of crystallization, $HgCl_2 . 2NH_3$, and not mercuri-diammonium chloride, $Hg(NH_3)_2Cl_2$, the infusible white precipitate is ammono-basic mercuric chloride, $NH_2HgCl$, a compound related to ammonia as the ordinary basic salts are related to water and is not mercuri-ammonium chloride, $HgNH_2Cl$, while the chloride of Millon's base is a salt basic both to ammonia and water and is not oxydimercuri-ammonium chloride nor yet a hydrated dimercuri-ammonium chloride.

*Potassium Ammono-zincate:* E. C. FRANKLIN and F. F. FITZGERALD.

Recalling the analogy between liquid ammonia and water as electrolytic solvents as emphasized in earlier papers by Frank-

lin and his co-workers, the authors have shown that potassium amide acts upon metallic zinc and upon zinc amide in liquid ammonia in a manner analogous to the well-known action of potassium hydroxide on metallic zinc and zinc hydroxide in aqueous solution. The ammono-potassium zincate, $Zn(NHK)_2$, analogous to the oxygen compound formed in aqueous solution, has been prepared. Other compounds belonging to this class undoubtedly exist, but have not yet been satisfactorily isolated.

*Liquid Methylamine as a Solvent:* H. D. GIBBS.

A consideration of the many analogies between water and liquid ammonia as electrolytic solvents has led to a study of methylamine which, formally related to ammonia as methyl alcohol is related to water, might be expected to exhibit interesting properties. It has been found to possess very wide solvent power; it unites with many inorganic salts and organic compounds as methylamine of crystallization, and it gives solutions with certain salts which exhibit unique conductivity curves.

*Hydronitric Acid:* L. M. DENNIS and HELEN ISHAM.

Anhydrous hydronitric ($HN_3$) was prepared by treating crystalline $KN_3$ with sulphuric acid (2:1). The dried gas was solidified by means of liquid air. Its melting-point is — 80°. The boiling-point of the liquefied acid is 37°. The determination of the vapor density by the Victor Meyer method showed that at a temperature about 25° above its boiling-point the acid possesses the molecular formula $HN_3$. Several new salts of the acid were prepared and studied. The reaction between dry hydronitric acid and dry hydrochloric acid was carefully examined and found to proceed according to the equation

$$3HN_3 + HCl = NH_4Cl + 4N_2.$$

INDUSTRIAL CHEMISTRY.

J. D. Pennock, Chairman.

*Notes on the Use of Peat:* CULLEN W. PARMELEE.

A restatement of some phases of the peat industry of especial interest to the agricultural chemist with particular reference to the use of it as a filler in fertilizers. The average nitrogen of 123 samples of New Jersey peats analyzed in the writer's laboratory is reported as 1.75 per cent.

*A Review of the American Cement Manufacture:* R. K. MEADE.

*Experiments made at Sault Ste. Marie, Ont., under the Auspices of the Canadian Government, in the Smelting of Iron Ores by the Electrothermic Process:* DR. EUGENE HAANEL.

In this paper Dr. Haanel points out the importance of the electric smelting process, especially for countries possessing water-powers and ore deposits, but lacking coal for metallurgical use, and gives a description of the plant erected and experiments conducted at Sault Ste. Marie, with a view of ascertaining several important items, which could not be obtained by the commission previously appointed by the Canadian government. (The report of this commission was published in 1904 by the Mines Branch of the Interior Department, Ottawa.)

The following is a summary of the results of the experiments: (1) Magnetite can be as economically smelted by the electro-thermic process as hematite. (2) Ores of comparatively high sulphur content can be made into pig iron containing only a few thousandths of a per cent. of sulphur. (3) The silicon content can be varied as required for the class of pig to be produced. (4) Charcoal which can be cheaply produced from mill refuse or wood which could not otherwise be utilized and peat-coke can be substituted for coke as re-

ducing agent. (5) A ferro-nickel pig can be produced practically free from sulphur from roasted nickeliferous pyrrhotite. (6) Titaniferous iron ores containing up to 5 per cent. of titanic acid can be successfully treated. (7) Under normal conditions an expenditure of 1,000 E.H.P. days is required for an output of twelve tons of pig iron.

*Classification of Coals:* S. W. PARR.

The classification proposes to proceed on the basis of the old nomenclature offered by Frazier, but it bases the distinctions upon data of a different sort. The main divisions in the classification are made to depend upon the ratio of the volatile carbon to the total carbon, and by volatile carbon is meant not the volatile matter as that term is sometimes erroneously applied, but the carbon part of the hydrocarbon constituents as indicated by the difference between total carbon and fixed carbon. This leads directly to a further factor, namely, that part of volatile matter which is inert and non-combustible, and this constituent is made to indicate the further subdivision in the bituminous coals proper, and between the bituminous coals and the lignites, as well as between the different forms of lignites themselves. The method of classification was illustrated by making use of the complete analytical results from over one hundred samples of coal selected from representative fields throughout the United States.

*Salt in the State of New York, its History, Resources and Manufacture:* F. E. ENGELHARDT.

The presence of salt in the state of New York is first recorded in the so-called 'Relations of the Jesuit Fathers,' by Father Jerome Lallemant and Father Charlevoix, 1645–6. First salt made by Father Simon LeMoyne in August, 1653. Practical manufacture of salt begun at Syracuse in 1788. The Indians ceded to the state of New York their land in the treaty at Fort Schuyler, 1788, except the lake and the lands for one mile round it, and in the treaty at Cayuga Ferry, 1795, they ceded this and a strip one half mile wide on the west side of Onondaga Creek from their village to the lake, about six miles long. The legislature of the state passed its first law regulating the manufacture of salt in 1797.

The manufacture of solar salt was begun in 1821, and in the same year Major B. Boyington sunk a well 300 feet deep for rock salt, without results. Wells were first square holes, about 30 feet deep by 20 feet wide, followed by cast-iron tubing of 8-inch bore; next came wooden tubing, and for the last fifty years wells have been tubed with 6- and 8-inch wrought-iron pipes. Wood was first employed as fuel, then semi-bituminous coal, and lately anthracite coal-dust with artificial draft. About 50 bushels of salt (of 56 pounds each) is the average result with good dust and brine of 68 salometer at 60° F. Largest amount of salt was produced in 1862, namely, 9,053,874 bushels. Total production up to date at Syracuse, about 433 million bushels, or over 12 million tons.

Salt is made in the state by artificial means, as in the kettle or Onondaga method, at Syracuse. In the western part of the state salt is made in the open pan, in grainers (the Michigan system) and in the vacuum pan. By solar heat in shallow wooden vats with movable wooden covers to protect them against rain. Their capacity is greatly increased by the so-called 'salt aprons.' This method is only practised at Syracuse. The total salt production of the state amounted, in 1905, to about 5,435,005 barrels of 280 pounds, or 5 bushels, each.

Rock salt was first discovered on June 20, 1878, in Wyoming County, on the farm

of Mr. Matthews, at a depth of 1,270 feet. The bed was 70 feet in thickness. The first shaft for mining the rock salt was finished in 1885. It is situated near Piffard, Livingston County, and is 1,018 feet deep. It is called the Retsof shaft. The Greigsville shaft is about one mile south of the former. The third shaft is two miles south of LeRoy and has a depth of 825 feet, and the fourth shaft was sunk at Livonia, Livingston County, to a depth of 1,430 feet. But one mine, the 'Retsof,' is at present operated.

All the salt wells of the state without exception, as well as these four salt shafts, obtain their brine or salt from one and the same rock-salt deposit, situated in the 'Upper Silurian.' It extends from Morrisville, Madison County, to Lake Erie, and from LeRoy to Watkins. The salt stratum is over 100 feet in thickness, depending entirely upon the configuration of the ground below the Silurian sea at the time of its formation. The rock salt occurs in one vein, two, three, four, five, six or even seven veins of various thickness and depth from the surface of the ground. The dip of the rock is southwest, about 41 to 46 feet.

The Solvay Process Company, after three attempts, finally obtained rock salt almost directly under the Tully Hills, which are 300 feet above, and has at present 51 wells, 30 on the east side, and 21 on the west side, of the Onondaga Valley, which at the present time supplies them with the brine required for the manufacture of soda ash, caustic soda, baking soda, etc.

*Sources of Some Common Impurities in C. P. Chemicals:* JAMES W. SCHADE.

The object of this paper is to present the sources of impurities in chemical reagents and to show that there are limits to the purity obtainable by manufacturers. The sources of impurities are: (1) the containers in which chemicals are shipped; (2) tanks, stills, condensers, and so on, in which chemicals are made; (3) reagents used to precipitate certain impurities or compounds formed by these reactions; (4) minerals from which the chemicals are made and materials used in manufacture. The danger of contamination by impurities of the first two classes may be minimized by careful selection of material for containers and apparatus. The presence of both barium and sulphate in a sample of sodium chloride and of calcium in ammonium oxalate are examples of impurities of the third class. Impurities of the fourth class are illustrated by the persistence of calcium in barium compounds and the constant association of nickel and cobalt in their purified salts. For ordinary work, however, reagents that will give accurate results can be manufactured at a reasonable cost.

*On the Determination of Carbon Disulphide and Total Sulphur in Commercial Benzol:* EDWARD S. JOHNSON.

(1) *The Determination of Carbon Disulphide.*—The principle underlying the method seemingly most widely applied is that of the transformation of carbon disulphide by means of alcoholic potash[1] into potassium xanthate, utilizing this substance as a medium for separation. For determination the potassium compound is best converted into cuprous xanthate and the latter into CuO. Much uncertainty exists apparently as to the exact composition of the so-called cuprous xanthate. If constituted as represented by the formula $(CS.OC_2H_5S)_2Cu_2$, the ratio of CuO produced to $CS_2$ entering into the formation of the xanthate should be 1.0:0.9563. Macagno[2] found 1.0:1.931, a little more than *twice* the theoretical. Others have obtained similar results. As evidently cuprous xanthate is not the compound under consideration, an investigation seemed

[1] Nickels, *Chem. News*, 43, 148.

[2] *Chem. News*, 43, 138.

desirable, and the more so because of a strong probability of a variation in composition with changing conditions of formation. Experiments were, therefore, made, operating with known quantities of carbon disulphide dissolved in pure benzol, to ascertain the desired *ratio under given, easily-realized conditions*. An average of 1.0:1.750 was found. The factors most strongly influencing the ratio, as far as studied, are size of the xanthate precipitate (the $CS_2$ present) and the time of its exposure to the mother liquors. By adhering to definite conditions very satisfactory analytical results are obtainable.

(2) *Determination of Total Sulphur in Benzol.*—The determination is accomplished by volatilization of the sample in a current of hydrogen and combustion of the vapors in an atmosphere of oxygen. The products of combustion are passed into a suitable absorption medium and the sulphur determined by familiar methods. A new *form of apparatus* for the combustion is described. The essential feature is the vertical combustion tube, 35 mm. in diameter and 170 mm. long. This is supplied with oxygen at the upper end, the products of combustion leaving at the bottom. The vapors are admitted by the burner-tube inserted through a horizontal arm in the center of the tube. Diametrically opposite is a similar arm carrying a pilot-flame tube. The flame, of hydrogen, is placed close to the burner-tip and serves to ignite the vapors at once upon their arrival, and further permits, evidently, the reestablishment of the combustion should it be accidentally or necessarily interrupted for a few moments. About 5 grams of benzol may be burned in three hours. Entirely satisfactory determinations were found possible. Samples with as much as 5 per cent. $CS_2$, and doubtless more, are readily handled with success. Insuring perfect and convenient combustion, the apparatus could be extended in its application to gases and vapors of whatever description. Fuel and illuminating gases are here in mind. It could further doubtless be made to lend itself in many instances advantageously to sulphur determinations in the ultimate analysis of organic compounds.

*The Technical Determination of Benzol in Illuminating Gas:* D. A. MORTON.

Examination of the method of Dennis and O'Neill for the determination of benzene in illuminating gas (*Jour. Amer. Chem. Soc.*, 1903, p. 503) shows that the results are low, and unless the reagent be freshly prepared for each test, not even approximately correct. Moreover, the absorbent (ammonium nickel nitrate solution) dissolves benzene only to the same extent as pure water, showing that the presence of nickel compound has no influence. As a practical method for the determination of benzol in coal gases, absorption by means of concentrated sulphuric acid is recommended. By the use of this reagent a good separation of benzol from ethylene is effected.

## BIOLOGICAL CHEMISTRY.

Waldemar Koch, Chairman.

*The Phosphorous Content of Feces Fat:* J. H. LONG.

It is stated in many works on physiological chemistry that lecithins and similar bodies are either absent or present only in traces in the fat extracted from feces. In a previous paper the author pointed out that an organic phosphorous compound of the lecithin type may be sometimes present in relatively large amounts. In the present paper the results are given of the analyses of feces fat from seven individuals in which the phosphorous content was found to vary within wide limits. This phosphorus was in organic combination and apparently in a

body of the lecithin type. Some statements are made of the possible sources of the lecithins in feces.

*Dissociable Compounds of Mucoids and other Proteins:* W. J. Gies.

We know practically nothing about the ways in which proteins are held in living protoplasmic structures. The molecules of the protein compounds are relatively so large that as yet our physico-chemical methods of measurement are inadequate to give us correct ideas of molecular size and intramolecular structure, although we know much about the lifeless and, in some respects, comparatively meaningless fragments into which protein molecules may be broken. Our ignorance of the fundamental biochemical relation of proteins to the associated constituents of protoplasm appears to be largely due to our vague knowledge of the chemical statics and dynamics of true cellular proteins, a fact which serves, however, as a constant stimulus to protein investigation. Among the many protein substances, the nucleoproteins and the glucoproteins are very important tissue constituents. The essential part of each of these natural type proteins and the part to which the usual name is applied appears to be a colloidal organic acid. The forms in which the acid radicals occur in cells and tissues have not been definitely made out, although it is natural to presume that the acid radicals are united directly to one or more distinctly basic radicals in each case, and that variations in the characters of such compounds are associated with physiological as well as pathological variations of cellular composition and tissue function. The author has attempted to get to the bottom of this complicated matter by making definite salts of these proteins with the aid of methods that could be relied upon to leave the acid radicals unchanged.

The writer has lately prepared calcium, sodium, potassium and ammonium salts of mucoid by the following process: The slightly alkaline solution of glucoprotein is dialyzed until neutral and then poured into a large excess of 95 per cent. alcohol, which causes the precipitation of the mucoid. This precipitate is purified by resolution, dialysis and reprecipitation. The final product is made anhydrous by treatment with absolute alcohol and ether. The comparatively pure salts thus obtained are light snow-white powders.

The author hopes that, by increasing the knowledge of artificial products, analogies with natural compounds would be not only more easily recognized but also the characters of functions of the compounds in living protoplasm would be more thoroughly understood.

G. R. White,
*Press Secretary.*

## SCIENTIFIC BOOKS.

*Leitfaden für den praktisch-chemischen Unterricht der Medizinier.* Zusammengestellt von Franz Hofmeister, Professor der physiologischen Chemie an der Universität Strassburg. II. Aufl. Braunschweig, Viewig u. Sohn. 1906. Pp. 136. Preis Mark 3.50.

This little book admirably describes laboratory courses in qualitative analysis, organic chemistry (so far as it may be of interest to the physician) and in physiological chemistry. The directions given for making tests are brief and precise and at many places reasons are given for the methods advised in making the tests. In this revision it appears that particular attention was given to the course in physiological chemistry so that it might include the results of the latest investigations bearing especially upon the tests for the substances concerned in that branch of science. In short, the book is one which excellently covers the ground in practical chemistry essential to medical students.

John Marshall.